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The Environmental Protection Agency created a tradable commodity called RINs (Renewable Identification Numbers)—serial numbers that allow tracking batches of biofuels—to enforce biofuel mandates. To prove they have met their annual biofuel obligations under the Renewable Fuels Standard gasoline and diesel producers and importers accumulate RINs, by either buying biofuels with attached RINs or by buying detached RINs offered in the RIN market. RINs become detached when biofuels are blended with diesel or gasoline. Blenders who are not obligated parties have no use for their RINs; thus they are willing sellers in the RIN market. The price at which RINs are bought and sold is measured in cents per gallon of ethanol. In 2013, RIN prices have varied dramatically, from less than 10 cents per gallon in January to over 140 cents per gallon in July. As of late October, RIN prices for corn ethanol are about 25 cents per gallon.

The surge in RIN prices early in 2013, along with the high July prices and the overall large amount of price variability, have led some to conclude that there must be something wrong with either the RIN market or the Renewable Fuels Standard. US senators have asked the Commodities Futures Trading Commission to investigate market manipulation, and obligated parties have called for repeal of biofuels mandates, because they feel the high cost of acquiring RINs shows that biofuel blending targets are unattainable. To determine whether or not there is any basis for these conclusions requires an understanding of the economic role that RIN prices play in ensuring that biofuel blending targets are met.

Principles of economic classes teach that in competitive markets, prices settle where the quantity of a product that sellers want to sell equals the quantity that buyers want to buy. Thus, market prices reflect both the value that buyers place on the product as well as the production costs. If demand increases, then the resulting price increase signals producers to expand production. If production costs decrease, then the price of the product falls to reflect lower production costs.

Demand for RINs exists solely because they are needed to meet EPA requirements. In a hypothetical market with no biofuel mandate there would be no demand for RINs so the price of RINs is zero. RIN prices are positive only when the number of RINs that obligated parties need exceeds the number that would be supplied absent the mandates.

When biofuels consumption is increased by mandates, the cost of producing the extra quantity of biofuels exceeds the value of the additional consumption. However, biofuels plants will not produce the additional quantity unless the price they receive covers their increased production costs. Blenders and consumers will not consume the extra quantity of biofuels produced unless the price they pay drops enough to make it an attractive purchase. Something must close this gap between the cost of production and the value of consumption, and this is the role that RIN prices play in the market. Thus, the difference

between the cost of producing additional biofuels and the value that the additional biofuels bring in the market determines RIN prices.

The low ethanol RIN prices that prevailed until January 2013 signaled that ethanol mandates did not force more consumption than was desired by buyers. The demand for ethanol was boosted by tax credits until December 2011, which partly explains why consumption levels exceeded mandates. However, obligated parties realized in January 2013 that the scheduled increases in mandated ethanol consumption in 2014 and beyond could not be easily met because consumption of ethanol in 10 percent blends was limited to about 13 billion gallons and ethanol mandates were scheduled to force consumption to 15 billion gallons in 2015. Thus, for the first time, it looked like the demand for RINs was going to exceed the supply of RINs, and not surprisingly, the price of RINs increased dramatically. What is surprising about the surge in RIN prices is not that it happened, but that it did not happen earlier.

RIN prices reflect the cost of complying with the Renewable Fuels Standard—when RIN prices are high, so too are the costs of compliance. Just as high crude oil prices increase the incentive to explore for more oil and find substitutes for gasoline, high RIN prices create an incentive to find lower-cost alternatives of meeting mandates. Costs can be lowered either by decreasing biofuel production costs or by increasing the value of biofuels in the market place.

The market for ethanol in the United States is limited by the number of stations that sell higher-than-10-percent ethanol blends. E15 and E85 are two fuel blends that can be sold in the United States containing up to 15 and 85 percent ethanol, respectively; however, sales of both are limited by a lack of pumps and tanks capable of handling the fuels at retail gasoline stations. We recently estimated that a maximum of about 14 billion gallons of ethanol could be consumed in the United States with the current infrastructure, but only if the price of E85 is low enough.¹ We also estimated that about one billion gallons of additional ethanol could be consumed for each additional 2,500 stations equipped to sell E85. What this means is that without an incentive to invest in infrastructure, ethanol consumption will always be limited to 14 billion gallons.

EPA is currently determining biofuel mandate levels for 2014. Suppose EPA decides on a mandate that requires consumption of 14 billion gallons of ethanol. RIN prices would then increase dramatically because the incremental value of ethanol to blenders and consumers is close to zero at 14 billion gallons with current infrastructure. Because high RIN prices imply high compliance costs, this mandate would create a large incentive to lower compliance costs. The most effective way to reduce compliance costs would be to invest in E85 infrastructure. Babcock shows that by investing no more than \$325 million,

¹Babcock, B.A., and S. Pouliot. 2013. "Price It and They Will Buy: How E85 Can Break the Blend Wall." Policy Brief (13-PB-11), Center for Agriculture and Rural Development, Iowa State University.
Babcock, B.A., and S. Pouliot. 2013. "Impact of Sales Constraints and Entry on E85 Demand." Policy Brief (13-PB-12), Center for Agriculture and Rural Development, Iowa State University.

compliance costs would be reduced by about \$1.75 billion.² Clearly, if EPA sets the mandate at difficult-to-achieve levels, the resulting increase in RIN prices will signal a large incentive to invest in the infrastructure that turns difficult-to-achieve mandates into easy-to-achieve mandates.

Press reports indicate that EPA may reduce 2014 ethanol mandates to levels that can be easily met with 10 percent blends. Ethanol RIN prices should fall to zero if EPA ultimately decides on this course. Because zero RIN prices imply zero compliance costs, there will be no incentive to avoid compliance costs by increasing investment in retail infrastructure. If EPA justifies such an easy-to-achieve mandate level by a need to avoid high RIN prices, then mandates will need to stay low because RIN prices will only stay low if mandates are easy to achieve. The only way out of this circle is if some outside group decides to invest in E85 infrastructure, thereby allowing EPA to expand mandates while keeping RIN prices low.

Rather than being a sign that something was wrong with RIN markets or the RFS, the surge in RIN prices in 2013 did what RIN prices are supposed to do: they signaled that mandates in 2014 and 2015 were going to be costly to achieve. The cure for high compliance costs is investment in E85 and E15 infrastructures, which, in turn, would allow for the higher future biofuel consumption levels that are envisioned in current policy.

² Babcock, B.A. 2013. "RFS Compliance Costs and Incentives to Invest in Ethanol Infrastructure." Policy Brief (13-PB-13), Center for Agriculture and Rural Development, Iowa State University.